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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/892,558	06/28/2001	Michael Binnard	371922005200	5067

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EXAMINER	
MULLINS, BURTON S	

ART UNIT	PAPER NUMBER
2834	

DATE MAILED: 09/24/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/892,558	Applicant(s) BINNARD, MICHAEL
	Examiner Burton S. Mullins	Art Unit 2834

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-42 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-42 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2&6 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statements (IDS) submitted on July 25, 2001 and April 10, 2002 were received and considered by the examiner.

Claim Objections

2. Claims 6, 9-11 and are objected to because of the following informalities:

In claim 6, the plural "currents" does not agree with the singular verb "is". Similarly, in claims 9-11, "coils" does not agree with "comprises".

In claim 16, line 1, insert ---step of--- before "determining".

In claim 17, line 1, insert ---step of--- before "determining".

In claim 42, change "has" to ---is----.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 18-28 and 30-41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 18, 20, 22, 23, 24 and 26-28, "the portion of the coil array" is vague and indefinite. What "portion" is this?

In claim 32, recitation "a controller determining information related to resultant torque" is vague. What is "information related to resultant torque" besides the resultant torque itself? Further, "a controller determining information related to resultant torque about the first, second and third directions between the first member and the second member generated by the driving force" includes several phrases without clear subjects. Does "between the first member and the second member" refer to the torque or the directions? Does "generated by the driving force" refer to the torque, directions, or first and second members?

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-9, 12-16 and 18-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Markle (US 6,072,251) in view of Galburt (US 4,952,858) and Ioi et al. (JP 3-213500). Markle teaches a six-dimensional x-y stage motor including magnet arrays 102 and coil arrays. 106 (Fig.1). Levitation of the stage occurs by interaction between the electro-magnetic field generated by the coils with the magnetic field of the magnets, with a servo

system controlling the magnitude of the current energizing the electromagnetic coils (c.7, lines 50-56; c.9, lines 25-38).

While Markle clearly determines currents to the coils to generate forces between the magnet and coil arrays, Markle does not elaborate details of his servo structure such as a determination of current adjustments. Neither does Markle teach determination of resultant torques of the stage.

Regarding the servo feature, Galburt teaches a standard six-degree-of-freedom planar motor including first and second interacting members comprising a monolithic stage 10 suspended in space with its position controlled in six degrees of freedom by flat coil actuators 36 on the sub-stage 12 (Fig.1; c.2, line64-c.3, line 20). Galburt further teaches tilt sensing means comprising electro-optical sensors 58 (c.4, lines 33-39) and feedback control means including relative monolithic to substrate position sensing and servo compensation (Fig.2; c.4, line 63-c.5, line 27; abstract). Galburt's sensors 56 and 58 measure the position between the first and second members. This sensed position signal is then combined with an acceleration feed forward signal to output a modified, i.e., compensatory, control signal to the sub-stage drivers (c.1, lines 56-64), i.e., the current in the drivers is adjusted based in part on the position signals.

Regarding the latter feature, Ioi teaches a controller for a gravity-free simulation device including a first member (a robot on ground 1), a second member (object 4) that interacts with the first member by means of the robot's active drive mechanism 2 (Fig.3) which generates a driving force on the second member such that it moves in six degrees of freedom (roll, pitch, yaw) relative to the first member. Control means includes a sensor 3 which detects, i.e.,

"determines," the forces and torque of the object 4 around multiple X, Y and Z axes (abstract). Feedback control balances the forces generated by the drive 2 with the various forces such as gravity acting on the object 4. The detection of torques of the object facilitates production of the "gravity-free state" or floating movement of the object.

It would have been obvious to one having ordinary skill in the art to modify Markle and provide a servo control per Galburt since this would have been desirable to control the position of the stage and further to provide a servo control per Ioi which detects torques acting on the driven member since such detection of torques would have been desirable in a feedback control system to control multiple-axis movement of the driven member.

Regarding claim 2, note that in Galburt, relative position between the magnet and coil arrays is determined by the sensors 48 (Fig.2).

Regarding claims 3 and 20, Markle's and Galburt's coils would necessarily be energized by sinusoidal, square or triangular current waveforms.

Regarding claim 4, the choice of currents would inherently affect the forces between the magnet and coil arrays per Markle (c.7, lines 50-56).

Regarding claims 5 and 22, the current adjustments per Galburt would be made for each coil in the array (c.5, lines 24-27).

Regarding claims 6, 14 and 23, Markle teaches independently commutated coils (c.10, lines 18-21), i.e., current may be applied to predetermined portions of the coil array. This would hold true for the modified current (claim 7).

Regarding claims 8 and 15, as seen in Fig.5 of Markle, the coils are partially within the magnetic fields of the magnet array.

Regarding claims 30-31, Galburt's apparatus is employed in a lithographic system for manufacturing wafers (c.1, lines 5-10).

Regarding claims 33-35, Galburt's sensors 56 and 58 measure the position between the first and second members. This sensed position signal is then combined with an acceleration feed forward signal to output a modified, i.e., compensatory, control signal to the sub-stage drivers (c.1, lines 56-64), i.e., the current in the drivers is adjusted based in part on the position signals. In Ioi, the torque is calculated based on the position readings of sensor 3.

Regarding claim 36, the Lorentz force is inherent in Galburt, i.e., it is the force that floats the monolithic stage which comes about through the interaction of the electro-magnetic fields generated by the coils with those of the magnet.

7. Claims 10-11 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Markle, Galburt and Ioi as applied to claims 1 and 12 above, and further in view of common knowledge. Markle teaches at least 6 coils (c.10, lines 18-21). Choice of 12 or 16 or more coils would involve ordinary engineering design since the number of coils would depend upon the particular size of the apparatus and intended application.

8. Claims 32-36 and 39-42 are rejected under 35 U.S.C. 103(a) as being unpatentable over in view of Galburt (US 4,952,858) in view of Ioi et al. (JP 3-213500). Galburt teaches a standard six-degree-of-freedom planar motor including first and second interacting members comprising a monolithic stage 10 suspended in space with its position controlled in six degrees of freedom by flat coil actuators 36 on the sub-stage 12 (Fig.1; c.2, line64-c.3, line 20). Galburt further teaches tilt sensing means comprising electro-optical sensors 58 (c.4, lines 33-

39) and feedback control means including relative monolithic to substrate position sensing and servo compensation (Fig.2; c.4, line 63-c.5, line 27).

Galburt does not specifically mention control means that "determin[es] information related to resultant torque" of the monolithic stage as it tilts and turns about the X, Y and Z axes.

Ioi teaches a controller for a gravity-free simulation device including a first member (a robot on ground 1), a second member (object 4) that interacts with the first member by means of the robot's active drive mechanism 2 (Fig.3) which generates a driving force on the second member such that it moves in six degrees of freedom (roll, pitch, yaw) relative to the first member. Control means includes a sensor 3 which detects the forces and torque of the object 4 around multiple X, Y and Z axes (abstract). Feedback control balances the forces generated by the drive 2 with the various forces such as gravity acting on the object 4. The detection of torques of the object facilitates production of the "gravity-free state" or floating movement of the object.

It would have been obvious to one having ordinary skill in the art to modify Galburt and provide a feedback control per Ioi which detects torques acting on the driven member since such detection of torques would have been desirable in a feedback control system to control multiple-axis movement of the driven member.

Regarding claims 33-35, Galburt's sensors 56 and 58 measure the position between the first and second members. This sensed position signal is then combined with an acceleration feed forward signal to output a modified, i.e., compensatory, control signal to the sub-stage

drivers (c.1, lines 56-64), i.e., the current in the drivers is adjusted based in part on the position signals. In Ioi, the torque is calculated based on the position readings of sensor 3.

Regarding claim 36, the Lorentz force is inherent in Galburt, i.e., it is the force that floats the monolithic stage which comes about through the interaction of the electro-magnetic fields generated by the coils with those of the magnet.

Regarding claims 39-42, Galburt's apparatus is employed in a lithographic system for manufacturing wafers (c.1, lines 5-10).

9. Claims 37-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Galburt and Ioi et al. as applied to claim 32 above, and further in view of Masanori et al. (JP 7-131966). Galburt teaches plural coils arranged in an array. Only one magnet 40 is used in the array, however.

Masanori teaches a two-dimensional stage motor including plural magnets 11 on a stage 13 arranged in a magnet matrix along the orthogonal axes of the driving shafts of the motor which interact with respective orthogonally-arranged drive coils 14 to move the stage. The magnets increase the motor "stroke length," i.e., the effective range of movement of the stage.

It would have been obvious to one having ordinary skill to employ plural magnets per Masanori in the apparatus of Galburt and Ioi since plural magnets would have been desirable to increase the stage's effective range of movement.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Burton S. Mullins whose telephone number is 305-7063. The examiner can normally be reached on Monday-Friday, 9 am to 5 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nestor Ramirez can be reached on 308-1371. The fax phone numbers for the organization where this application or proceeding is assigned are 305-1341 for regular communications and 305-1341 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 308-0956.

BSMullins

Burton S. Mullins
Primary Examiner
Art Unit 2834

bsm
September 20, 2002